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A NEW SPECIES OF *ACMAEA* (ARCHAEOGASTROPODA) FROM THE PLEISTOCENE OF SAN NICOLAS ISLAND, CALIFORNIA

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By JERE H. LIPPS

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DAVID K. CALDWELL
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A NEW SPECIES OF *ACMAEA* (ARCHAEOGASTROPODA) FROM THE PLEISTOCENE OF SAN NICOLAS ISLAND, CALIFORNIA

By Jere H. Lipps[1]

Abstract: A new species, *Acmaea mitchelli* which possesses shell sculpture of imbricate ribs, is described from Pleistocene marine terrace deposits on San Nicolas Island, California. It is compared with and differentiated from similar species of *Acmaea* from California. Evidence suggests that the new species lived on rocks in the high intertidal zone somewhat above mean tide level. The new *Acmaea* may be related to *A. limatula*.

Collections of invertebrates made by members of the Los Angeles County Museum, the U.S. Geological Survey, and myself include over 200 specimens of a new species of *Acmaea* from six localities (Fig. 1) in Pleistocene marine terrace deposits on San Nicolas Island, Ventura County, California. These collections suggest that a large population of this new species co-existed with other species of *Acmaea* on the island during the Pleistocene. On this basis and the distinct morphology of the specimens, the description of this *Acmaea* is presented herein.

References to the Los Angeles County Museum Section of Vertebrate Paleontology are hereafter abbreviated as LACM VP, those to the Section of Invertebrate Paleontology as LACM IP, those to the U.S. Geological Survey as USGS, and those to the invertebrate paleontology collections, Department of Geology, University of California, Los Angeles as UCLA.

Systematic Description

Class Gastropoda Cuvier, 1797
Order Archaeogastropoda Thiele, 1925
Suborder Patellina von Ihering, 1876
Family Acmaeidae Carpenter, 1857
Genus *Acmaea* Eschscholtz, 1833
Acmaea mitchelli new species
Fig. 2, a-d; Fig. 3, a-kk; Fig. 4, a-kk

Acmaea n. sp. Vedder *in* Vedder and Norris, 1963, U.S. Geol. Survey Prof. Paper 369, table 4, p. 40.

Diagnosis: Apex in anterior half of shell; sculpture of evenly radiating ribs; ribs narrow, imbricate with nodes which may be hollow ventrally; internal color white with an even brown marginal band.

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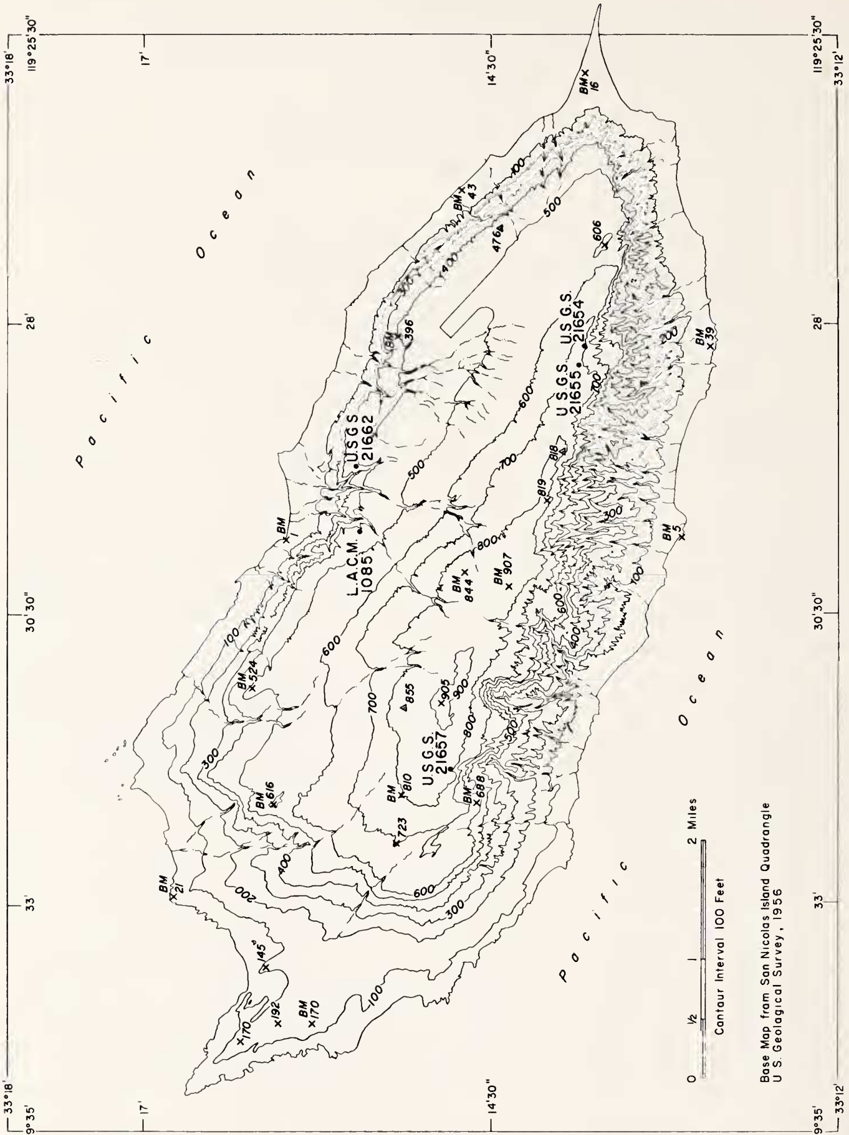


Figure 1. Map of San Nicolas Island, Ventura County, California, showing the type locality (LACM VP 1085) of *Acmaea mitchelli* Lipps, new species, and other localities from which specimens of *A. mitchelli* have been collected.

Description: Shell an open cone, medium in size for the genus, bilaterally symmetrical, thicker in apical region. Outline elliptical. Apex acute, inflected anteriorly so that it projects slightly beyond the surface of the anterior end-face. Anterior end-face straight in profile. Posterior and lateral faces convex outward. Sculpture of ribs radiating from the apex with one to three ribs intercalated between the primary ribs. Ribs prominent, narrow, rounded, imbricate, straight on anterior and posterior end-faces, curved posteriorly on lateral faces, increasing in height and width near margin of shell. Imbrications on ribs form nodes which may be hollow ventrally. Ribs intercalated between primary ribs slightly narrower and less prominent. Spacing of ribs nearly uniform with interspaces narrower than width of adjacent ribs. Growth lines conspicuous. Color brownish gray externally. Margin of shell arched dorsally along lateral edges, crenulate due to expression of ribbing. Aperture elliptical. Internal color white except for an even brown marginal band extending dorsally from margin for about one-third of interior of shell. Brown band semi-glossy. White area next to brown band glossy. Apical area dull. Internal surface faintly reflects the external ribbing.

Holotype: No. 1126 LACM IP collections. Length 28.0 mm.; width 20.6 mm.; height 10.9 mm.; distance from apex to anterior margin of shell 7.3 mm. Collected by Edward D. Mitchell, Jr., April 16, 1960, at LACM VP Locality 1085.

Paratypes: Thirty-six figured paratypes nos. 1127-1 to 1127-36 and 46 unfigured paratypes nos. 1127-37 to 1127-82, LACM IP collections. Twenty-five unfigured paratypes nos. 12155, 12155 a-x, Type Collection, Department of Paleontology, California Academy of Sciences. Twenty-five unfigured paratypes no. 34970, UCLA. All paratypes were collected by Jere H. Lipps and Edward D. Mitchell, Jr., April, 1960 from LACM VP Locality 1085.

Etymology: This species is named for Edward D. Mitchell, Jr., Vertebrate Paleontology Section, Los Angeles County Museum, who found the holotype and many of the paratypes, in recognition of his studies of the paleontology of the California Channel Islands.

Type locality and occurrence: LACM VP Locality 1085, San Nicolas Island, Ventura County, California (same as USGS Locality 21666): at the head of a small gully which joins the second western tributary to Mineral Creek (the most westerly of three deep canyons which empty into the sea just west of Coney Point). The locality is 5775 feet north and 3500 feet east of 33°14′ 30″ N., 119°30′30″ E.; San Nicolas Island Quadrangle (ed. 1943, reprinted 1952). Altitude about 425 feet above sea level. See Figure 1.

In addition to the type locality, *Acmaea mitchelli* was found at USGS Localities 21654, 21655, 21657, and 21662 (J. G. Vedder, written communication; and personal collections). The type locality and USGS Locality 21662 are on the northern side of the island; the remainder are on the southern side in terrace deposits at higher elevations (see Fig. 1).

Age: Kanakoff (*in* Howard, 1955:137) considered the molluscan assemblage from LACM VP Locality 1085 to correspond to the cold water fauna of the Lower Pleistocene deposits on the mainland. Vedder and Norris (1963:

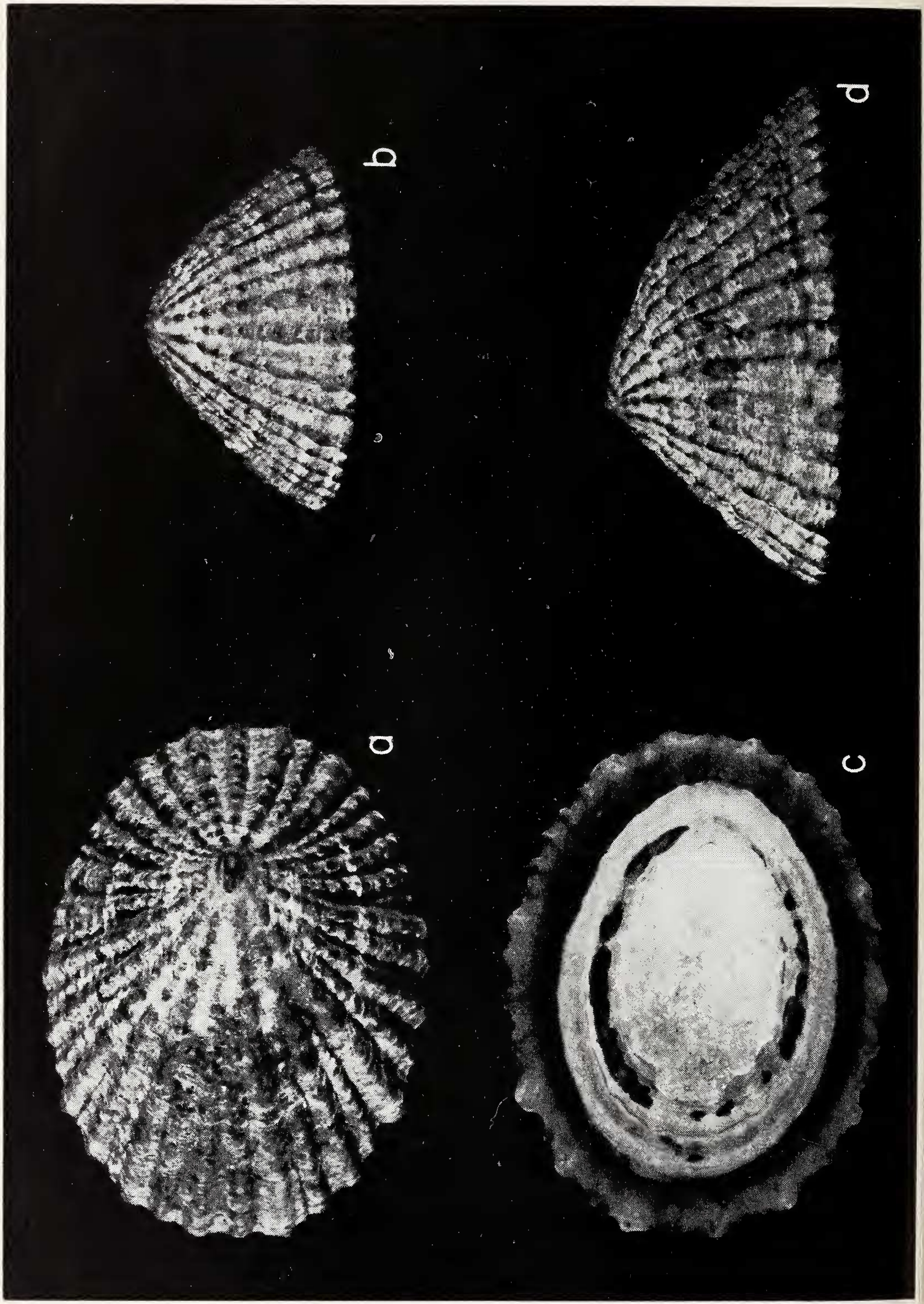


Figure 2. Acmaea mitchelli Lipps, new species. Holotype LACM IP 1126. Dorsal (a), anterior (b), ventral (c), and left lateral (d) views of the shell. Approximately 2½ times natural size. Locality LACM VP 1085, Pleistocene marine terrace deposit, San Nicolas Island, Ventura County, California.

52-53) have tentatively dated the terraces as Late Pleistocene on the basis of geomorphic and faunal evidence.

Variation: Shell characters within one species of *Acmaea* may be extremely variable due to response to ecologic stresses, and the specimens of *A. mitchelli* thus show many variations (see Figs. 3 and 4). Individuals of *A. mitchelli* with a smaller periphery may be flattened, whereas those with a larger periphery have a relatively higher spire. The shell perimeter is commonly elliptical or oval, but in smaller specimens may be nearly circular, and in some specimens may be irregular and no longer bilaterally symmetrical. The apex is situated in the anterior half of the shell and its position ranges from subcentral to distinctly anterior. The anterior end-face is commonly flat in profile, but may be convex in differing degrees. Some individuals have more widely spaced and fewer ribs than the holotype. The margin of the shell is often thicker than the rest of the shell, resulting in constriction of the aperture. One paratype (LACM IP no. 1127-2; dorsal and ventral views in Figs. 3-c; 4-c) shows distortion of the right-lateral face with incomplete development there of the ribs. These features may have been due to the animal living next to a hard surface. The ornamentation of the individual ribs and the pattern of internal coloration vary only slightly. The internal marginal brown band varies in width and intensity of coloration, but this in part may be due to preservation.

SIMILAR SPECIES OF CALIFORNIA *Acmaea*

Seven species of *Acmaea,* which also occur in California, are herein illustrated for comparison with *A. mitchelli* and their similarities and distinctive characters noted. Reference to the original description of each species is also given.

Acmaea conus Test
Figures 5 (g-h); 6 (g-h)

Test, A. R. (G.), 1945, Nautilus, 58: 92-96.

Acmaea conus differs from *A. mitchelli* in its roughly rounded ribs which are irregularly spaced and commonly branched. Internally, *A. conus* has a dark apical spot not found in *A. mitchelli.*

Acmaea digitalis Eschscholtz
Figures 5 (a-c); 6 (a-c)

Eschscholtz, F. *in* Rathke, M. H., 1833, Zoologischer Atlas, 5:20, pl. 23, figs. 7-8, Berlin.

This species is very similar to *A. mitchelli* in shell form. Ribs of *A. digitalis* are spaced widely, rarely intercalated, and neither imbricated nor very pronounced. The apex of *A. digitalis* is normally far anterior on the shell and it is recurved. *A. digitalis* has a characteristic dark apical spot and variable marginal coloration not found in *A. mitchelli.*

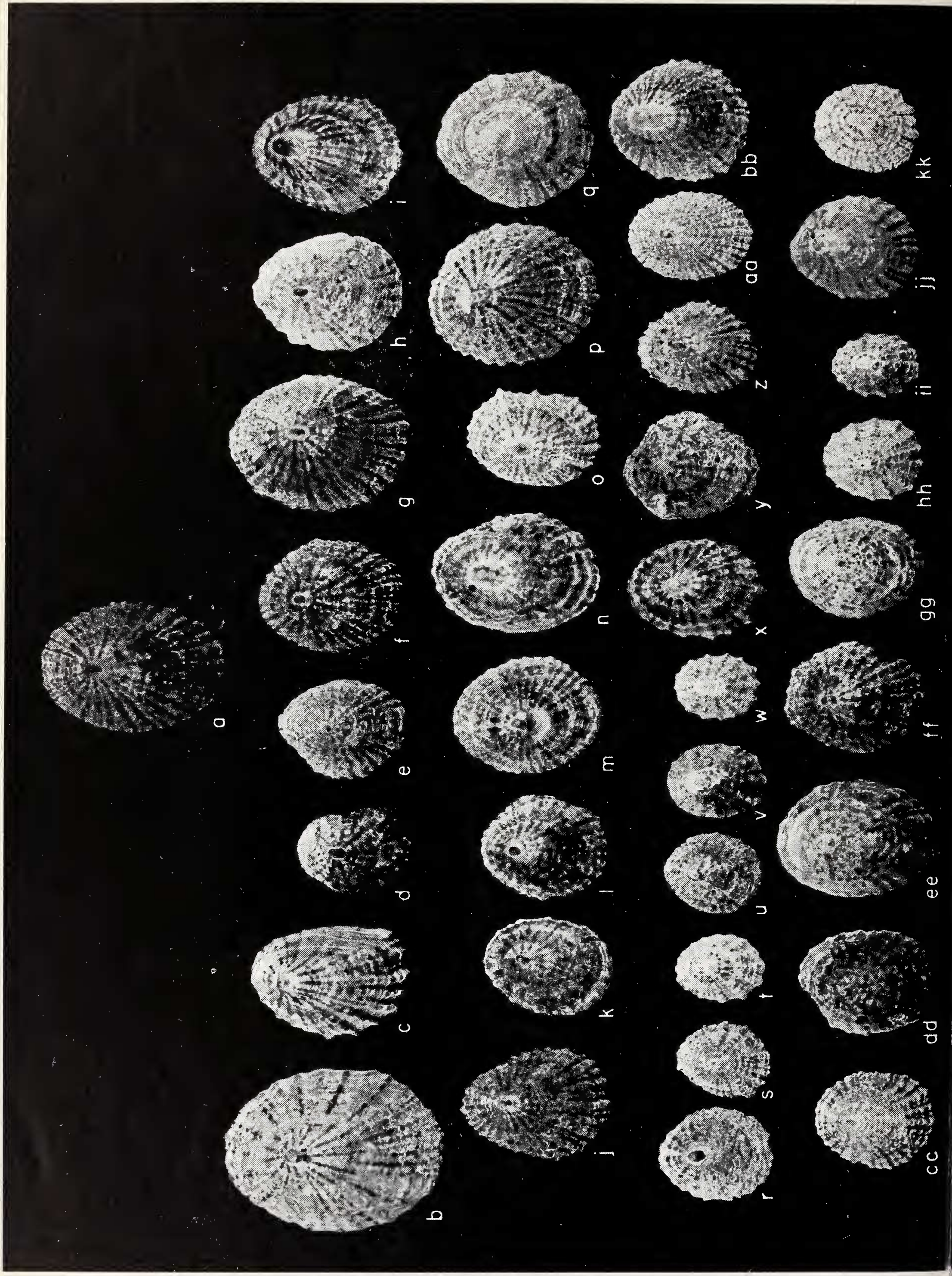


Figure 3. Acmaea mitchelli Lipps, new species. Dorsal view of the holotype (a), LACM IP 1126, and 36 paratypes (b-kk), LACM IP 1127-1 to 1127-36. Natural size. Locality LACM VP 1085, Pleistocene marine terrace deposit, San Nicolas Island, Ventura County, California.

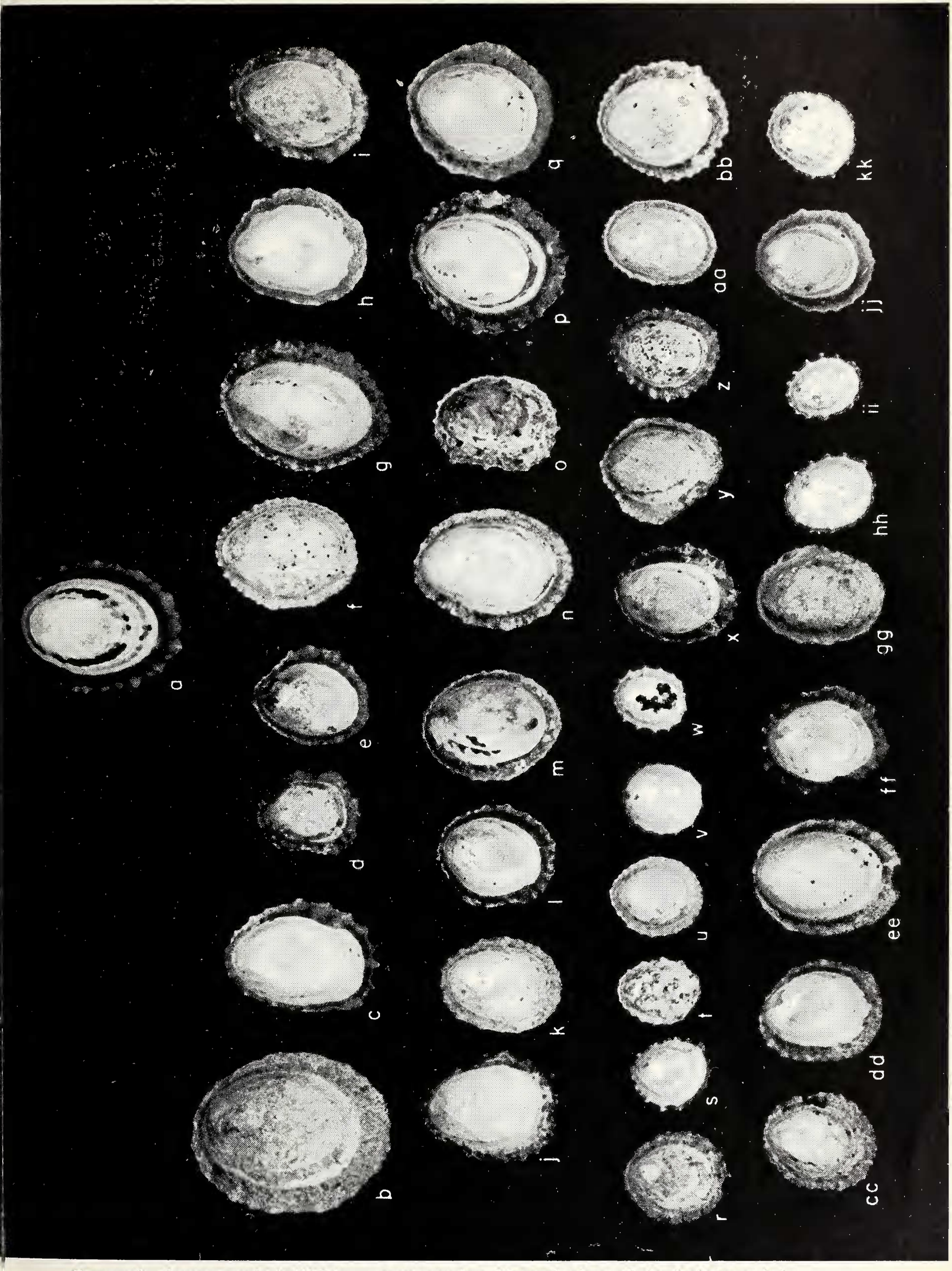
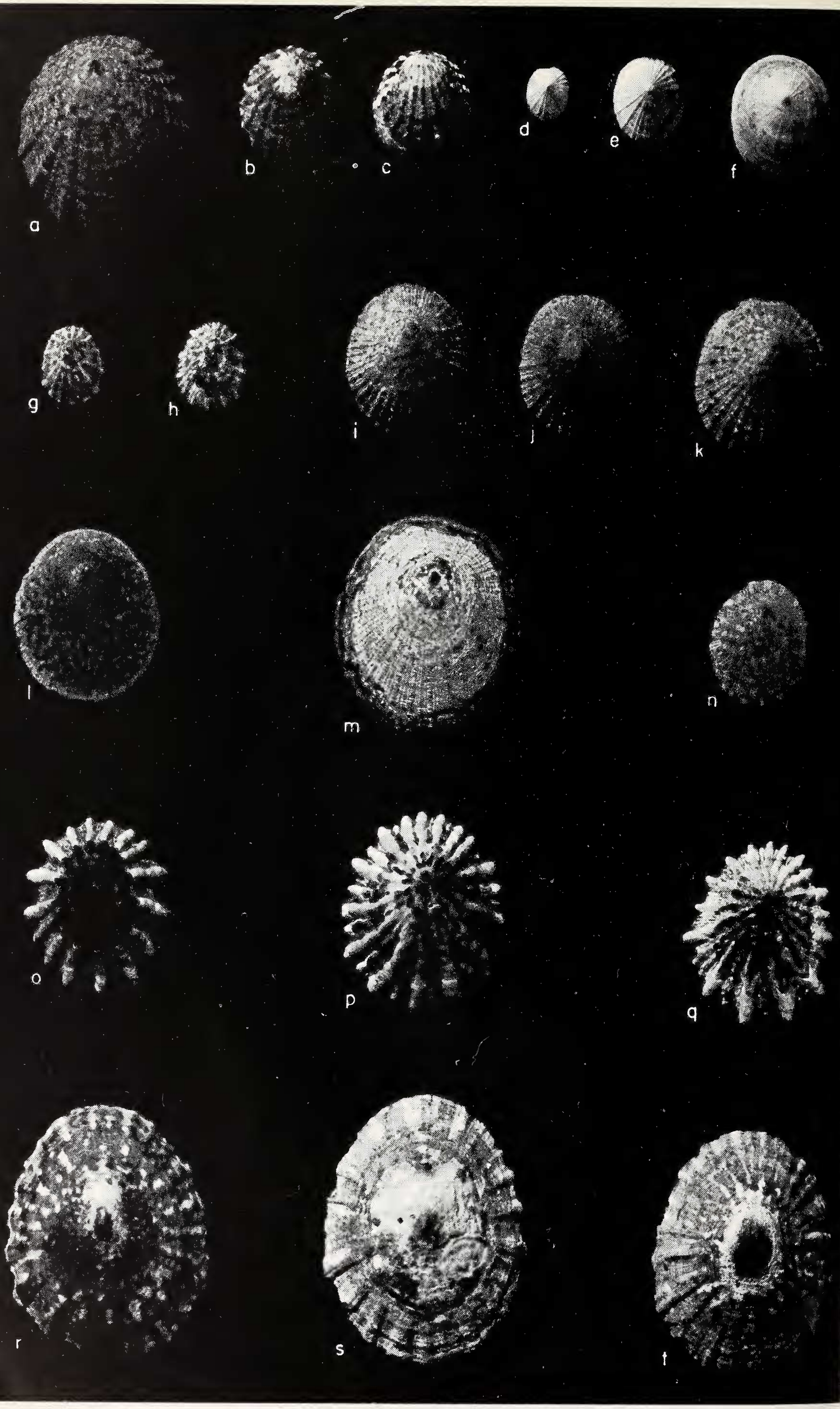


Figure 4. Acmaea mitchelli Lipps, new species. Ventral view of the holotype (a), LACM IP 1126, and 36 paratypes (b-kk), LACM IP 1127-1 to 1127-36. Natural size. Locality LACM VP 1085, Pleistocene marine terrace deposit, San Nicolas Island, Ventura County, California.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Acmaea funiculata (Carpenter)

Figures 5 (d-f); 6 (d-f)

Carpenter, P. P., 1864, Rept. British Assoc. Adv. Sci., 1863: 612, 650.

This *Acmaea* differs from *A. mitchelli* in having a relatively higher spire, sculpture consisting of thin, irregularly spaced ribs radiating from the apex, and a shell which is white in color, externally and internally.

Acmaea limatula Carpenter

Figures 5 (l-n); 6 (l-n)

Carpenter, P. P., 1864, Rept. British Assoc. Adv. Sci., 1863: 540.

A. limatula generally has a lower and rounder shell than does *A. mitchelli,* and the sculpture consists of from two to five finely imbricate ribs between more pronounced ribs. These pronounced ribs closely resemble the imbricated ribs of the new species. Internally, *A. limatula* has a dark apical spot.

Acmaea limatula morchii Dall

Figures 5 (i-k); 6 (i-k)

Dall, W. H., 1878, Proc. U.S. Natl. Mus., 1: 47.

This subspecies shows a close resemblance to *A. mitchelli,* as their shells have a similar shape, the same relative shell height, constricted aperture, and imbricate ribs with nodes which have concave hollows on their ventral sides. *A. limatula morchii* differs from *A. mitchelli* in having less prominent radial ribs, fine intermediate ribs between the principal ones, the nodes of the ribs are more concave on the ventral side, and there is a dark apical spot internally.

Acmaea pelta Eschscholtz

Figures 5 (r-t); 6 (r-t)

Eschscholtz, F., *in* Rathke, M. H., 1833, Zoologischer Atlas, 5:19, Berlin.

This species displays a varied external color pattern of bands or checkerboards. The anterior end is commonly more narrow than the posterior end and the faces of the shell are usually planar. Ribs, when present, are heavy

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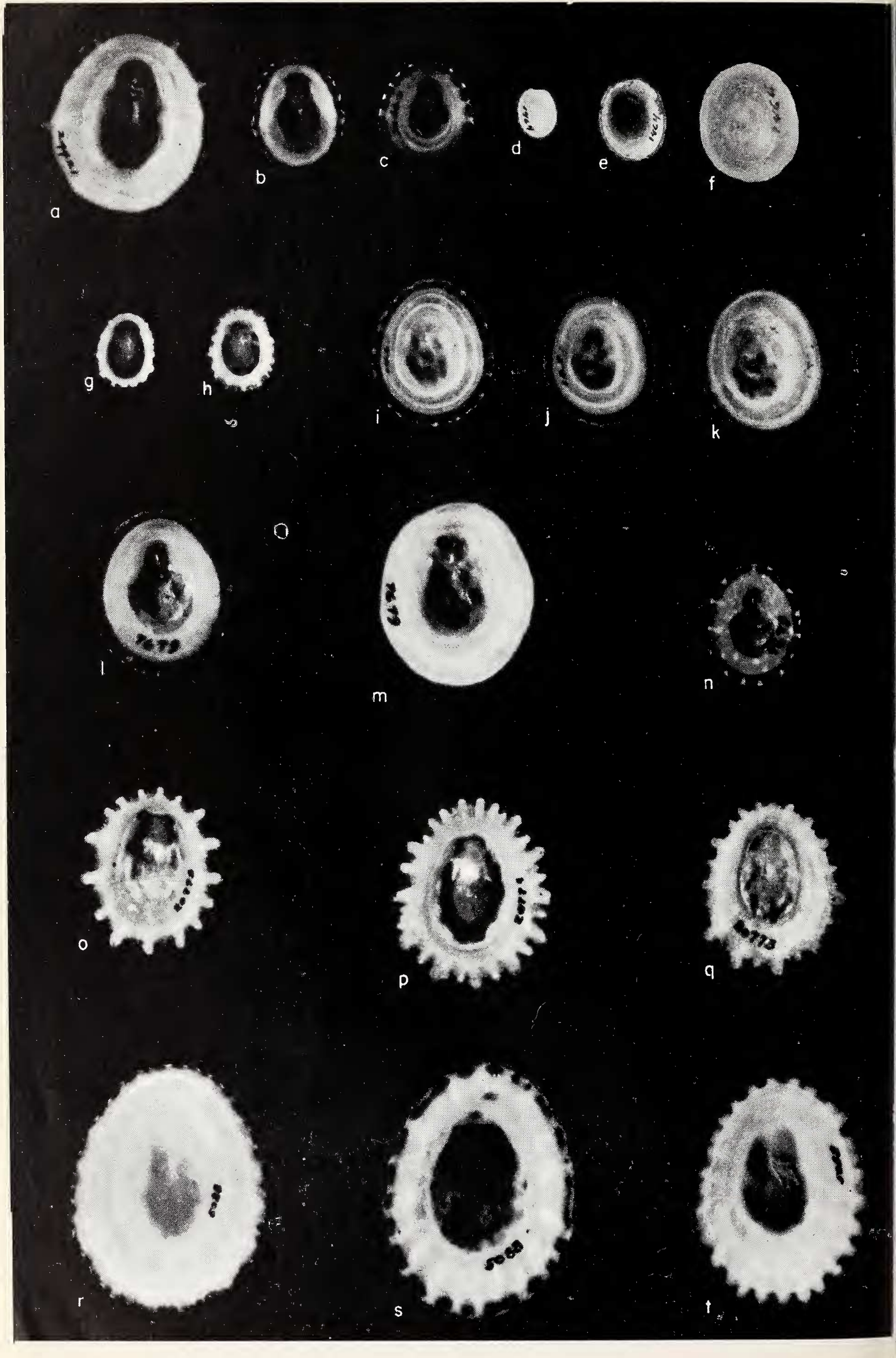
Figure 5. Dorsal view of similar species of California *Acmaea.* All illustrations approximately natural size. a-c. *A. digitalis* Eschscholtz from Laguna Beach, Calif., UCLA hypotypes: a. no. 35295; b. no. 35296; c. no. 35297. d-f. *A. funiculata* (Carpenter) from Catalina Island, Calif., at 30-40 fathoms. UCLA hypotypes: d. no. 35298; e. no. 35299; f. no. 35300. g-h. *A. conus* Test from mouth of Santa Ynez Canyon, Calif. LACM IP hypotypes: g. no. 1128-1; h. no. 1128-2. i-k. *A. limatula morchii* Dall. UCLA hypotypes: i. no. 35301; j. no. 35302; k. no. 35303. l-n. *A. limatula* Carpenter from Morro Bay, Calif. UCLA hypotypes: l. no. 35304; m. no. 35305; n. no. 35306. o-q. *A. scabra* (Gould) from San Pedro, Calif. UCLA hypotypes: o. no. 35307; p. no. 35308; q. no. 35309. r-t. *A. pelta* Eschscholtz from San Francisco Bay, Calif. UCLA hypotypes: r. no. 35310; s. no. 35311; t. no. 35312.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and broad, nonspinose, and widely spaced. A dark internal coloration is commonly present posterior to the apex on the inside of the shell. With the exception of a somewhat narrowed anterior end in some specimens, *A. mitchelli* has none of the above characters.

Acmaea scabra (Gould)
Figures 5 (o-q); 6 (o-q)

Gould, A. A., 1846, Proc. Boston Soc. Nat. Hist., 2:152.

The shells of *A. scabra* have very heavy ribs with nodes, or more rarely spines. The ribs are generally fewer in number, broader, not imbricate, and more widely spaced than those of *A. mitchelli*. Commonly, *A. scabra* has a markedly scalloped marginal outline whereas *A. mitchelli* does not. The internal coloration of *A. scabra* differs considerably, generally consisting of scattered brown markings or a dark apical spot, or more rarely only a regular marginal band as in *A. mitchelli*.

PALEOECOLOGY OF *Acmaea mitchelli*

Test (1946) stated that it is possible to determine the ecologic niche of a species of *Acmaea* by means of certain adaptive features of the shells. The following characteristics, which Test (1945; 1946) stated are adaptations to an ecologic niche, are displayed by the shells of *A. mitchelli*: 1) the restriction of the aperture in many specimens, an adaptation to prevent dessication in limpets subject to exposure; 2) a thick, heavy shell and prominent sculpture, which serve to withstand the impact of ocean waves on the animal; 3) an irregular margin caused by conformation to the substrate where the animal lived; and 4) a relatively high spire, which Test (1945) attributed to exposure or other unfavorable conditions, but which Shotwell (1950) considered a result of growth. These shell features suggest that in life *A. mitchelli* was subject to long periods of exposure and wave action.

Acmaea mitchelli is found associated with molluscan species (see Vedder and Norris, 1963, table 4) representing the "exposed rocky shore association: *Mytilus californianus-Littorina planaxis* community" of Valentine

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Figure 6. Ventral view of similar species of California *Acmaea*. All illustrations approximately natural size. a-c. *A. digitalis* Eschscholtz from Laguna Beach, Calif. UCLA hypotypes: a. no. 35295; b. 35296; c. no. 35297. d-f. *A. funiculata* (Carpenter) from Catalina Island, Calif. at 30-40 fathoms. UCLA hypotypes: d. no. 35298; e. no. 35299; f. no. 35300. g-h. *A. conus* Test from mouth of Santa Ynez Canyon, Calif. LACM IP hypotypes: g. no. 1128-1; h. no. 1128-2. i-k. *A. limatula morchii* Dall. UCLA hypotypes: i. no. 35301; j. no. 35302; k. no. 35303. l-n. *A. limatula* Carpenter from Morro Bay, Calif. UCLA hypotypes: l. no. 35304; m. no. 35305; n. no. 35306. o-q. *A. scabra* (Gould) from San Pedro, Calif. UCLA hypotypes: o. no. 35307; p. no. 35308; q. no. 35309. r-t. *A. pelta* Eschscholtz from San Francisco Bay, Calif. UCLA hypotypes: r. no. 35310; s. no. 35311; t. no. 35312.

(1961). *A. mitchelli* occurs most abundantly nearer the paleo-shoreline (see Vedder and Norris, 1963, pl. 2), as inferred from field relations of the sediments and the terrace platform, than the paired valves of pelecypods and remains of other animals indicative of the mid-intertidal zone of Valentine (1961: fig. 2). Many well-preserved shells of *A. mitchelli* were found in close association with articulated foot bones of the extinct flightless goose *Chendytes milleri* Howard, which Miller (1960) interpreted as having been deposited in the high intertidal zone.

These interpretations and observations suggest that *A. mitchelli* occupied an ecologic niche in the high intertidal zone probably somewhat above the average mean tidal level where wave impact and exposure were important factors affecting marine life.

Many specimens of *A. mitchelli* have distorted or irregular margins (see Figs. 3 and 4). Such features occur in Recent limpets living on rocks in the high intertidal, which regularly return to the same spot after foraging short distances for food, as does *A. scabra* (see Hewatt, 1940). Thus, it may be inferred that *A. mitchelli* likewise returned consistantly to the same spot after foraging for food, and that it also lived on rocks (many are present in the deposit and were undoubtedly available during the Pleistocene).

Acmaea mitchelli may have competed with *A. digitalis* and *A. scabra*, with which it is associated in the Pleistocene deposits, and which today occupy a position in the high intertidal zone. The other modern occupant of this zone, *A. conus*, is not known to occur in the Pleistocene sediments of San Nicolas Island.

PHYLETIC RELATIONSHIPS

True phyletic relationships of species of *Acmaea* are difficult to establish positively on the basis of shell morphology and should properly be based on certain characteristics of the radular ribbon (Test, 1946). Lacking the radular ribbon, the paleontologist can, at best, only suggest possible relationships.

Shell characters of *A. mitchelli* are most like those found in the closely related group of *A. scabra*, *A. digitalis* and *A. limatula*. Of this group, *A. limatula* and its varieties have shell sculpture (supposedly a conservative character) similar to that of *A. mitchelli* and this similarity may indicate a phyletic relationship.

ACKNOWLEDGMENTS

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